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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/613,203	07/03/2003	Gurtej S. Sandhu	303.931US2	4599

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EXAMINER
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MALDONADO, JULIO J

ART UNIT	PAPER NUMBER
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2823

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/20/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/613,203

Applicant(s)

SANDHU ET AL.

Examiner

Julio J. Maldonado

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 13 July 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-13, 52, 53 and 60-62 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 52, 53 and 62 is/are allowed.
- 6) ☒ Claim(s) 1-13, 60 and 61 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- ☐ Notice of Informal Patent Application
- ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-4, 8-13, 60, 61 are rejected under 35 U.S.C. 102(e) as being anticipated by Summerfelt et al. (U.S. 6,362,068 B1, hereinafter Summerfelt).

Summerfelt (Figs.1-5) teaches a capacitor structure including a bottom electrode layer (30); a first high-dielectric layer (32) contacting said bottom electrode layer (30), wherein said first dielectric layer is selected from the group including strontium titanate, metal-doped strontium titanate (Table 2) or other relatively low leakage current density perovskite, ferroelectric or high dielectric constant oxide; a second high dielectric layer (34) selected from the group including barium strontium titanate or metal-doped perovskite layers (such as strontium titanate or barium strontium titanate) (Table 2); a third high-dielectric layer (32) selected from the group including strontium titanate or metal-doped strontium titanate (Table 2); and a top electrode (46), wherein said first dielectric layer has a first thickness, said second dielectric layer has a second thickness and said first thickness is different than said second thickness, said first, second and

third dielectric layers form a plurality of dielectric layers (column 3, line 17 – column 6, line 10).

Summerfelt fails to expressly disclose wherein at least two layers of said dielectric layer of said plurality exhibit different degrees of oxidation. However, the recitation of lower degree of oxidation is seen to be a recitation of a greater concentration of free metal with respect to another layer with a lower concentration of free metal. Having said this, Summerfelt is open to form a first layer of metal-doped strontium titanate (Table 2) (that is, a layer of strontium titanate with free metal therein) and a second layer of barium strontium titanate and metal-doped barium strontium titanate. Furthermore, the submitted disclosure teaches wherein materials for the dielectric layers include perovskites, ferroelectrics, high-dielectric-constant oxides, acceptor doped perovskites, acceptor doped ferroelectrics, acceptor doped high-dielectric-constant oxides, donor doped perovskites, donor doped ferroelectrics, donor doped high-dielectric-constant oxides, and combinations thereof. The high-dielectric-constant material may be doped with a material selected from: Na, Al, Mn, Ca, La, Nb, F, K, Cr, Mn, Co, Ni, Cu, Zn, Li, Mg, Cl, V, Mo, Ce, Pr, Nd, Sn, Eu, Gd, Tb, Dy, Ho, Er, Ta, W, and combinations thereof (Instant paragraph [0035]). Therefore, Summerfelt et al. teach these limitations because Summerfelt discloses metal-rich (free metal) dielectric layers.

Summerfelt fails to expressly disclose wherein said second dielectric layer has a lower oxygen concentration than said first dielectric layer or wherein said layers exhibit different amounts of oxygen per unit volume. However, Summerfelt is open to form a

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first layer of metal-doped strontium titanate (Table 2) (that is, a layer of strontium titanate with free metal therein) and a second layer of barium strontium titanate and metal-doped barium strontium titanate. Therefore, the ratio of oxygen and the amount of oxygen per unit volume in the second dielectric layer could be lower compared to the first dielectric layer of Summerfelt. Accordingly, Summerfelt inherently teaches upon the claimed invention.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Summerfelt et al. (U.S. 6,362,068 B1) as applied to claims 1-4 and 8-13 above, and further in view of the following comments.

In reference to claims 5-7, Summerfelt substantially teaches all aspects of the invention but fail to disclose wherein said plurality of dielectric layers defines a thickness at most 200 angstroms; wherein said first dielectric layer has a thickness of at least 10 angstroms; and wherein said plurality of dielectric layers comprises a first dielectric layer contacting said bottom electrode and defining a thickness of at least one monolayer. However, the selection of the thicknesses is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species to obtain a desired dielectric layer. Therefore, it would have been

obvious to one of ordinary skill in the art at the time the invention was made to arrive at the claimed dimensions through routine experimentation.

***Allowable Subject Matter***

5. Claims 52, 53 and 62 are allowed.
6. The following is a statement of reasons for the indication of allowable subject matter: the prior art of record fails to disclose wherein at least one layer of said plurality manifests greater oxidation than would an equal thickness of an underlying layer of said plurality.

***Response to Arguments***

7. Applicant's arguments filed 05/02/2006 have been fully considered but they are not persuasive.

Applicants argue, "...Turning now to the Summerfelt reference, an electrode interface structure using high dielectric-constant materials is disclosed. Referring now in particular to Figure 3, the disclosed structure includes an electrode structure 30, and a strontium titanate (ST) layer 32 applied to the electrode structure 30. An additional ST layer 36 is applied to the structure, with a barium strontium titanate (BST) layer 34 interposed between the ST layers 32 and 36. As best understood, the Examiner bases his "logical argument" on the bald assertion that differences in oxidation levels between layers in the dielectric structure is equivalent to differences in a concentration of a "free metal" in the dielectric layers allegedly disclosed in the Summerfelt reference.

Assuming, arguendo, that the Examiner's position regarding the asserted reference is

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valid (which Applicants do not), it is still not evident where in the cited reference the asserted disclosure may be found. Applicant, in particular, notes that Summerfelt does disclose at column 4, lines 7-9 that: "...The deposition of the of the ST layers 32 and 36, and the BST layer 34 may be performed using substantially the same processes..." (Emphasis added). Further, at column 4, lines 14-17, Summerfelt also discloses that: "...Since the ST 32 and 36, and BST 34 are substantially similar chemically...." (Emphasis added). Accordingly, Applicants submit that, even according to the Examiner's own erroneous standard, the reference does not support the assertion that the disclosed layers include different concentrations of a "free metal". Instead, the Summerfelt reference teaches forming dielectric layers having substantially the same chemical composition, and are formed using substantially the same processes...". In response to this argument, as stated hereinabove, Summerfelt fails to expressly disclose wherein at least two layers of said dielectric layer of said plurality exhibit different degrees of oxidation. However, the recitation of lower degree of oxidation is seen to be a recitation of a greater concentration of free metal with respect to another layer with a lower concentration of free metal. Having said this, Summerfelt is open to form a first layer of metal-doped strontium titanate (Table 2) (that is, a layer of strontium titanate with free metal therein) and a second layer of barium strontium titanate and metal-doped barium strontium titanate. Furthermore, the submitted disclosure teaches wherein materials for the dielectric layers include perovskites, ferroelectrics, high-dielectric-constant oxides, acceptor doped perovskites, acceptor doped ferroelectrics, acceptor doped high-dielectric-constant oxides, donor doped perovskites, donor doped

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ferroelectrics, donor doped high-dielectric-constant oxides, and combinations thereof.

The high-dielectric-constant material may be doped with a material selected from: Na, Al, Mn, Ca, La, Nb, F, K, Cr, Mn, Co, Ni, Cu, Zn, Li, Mg, Cl, V, Mo, Ce, Pr, Nd, Sn, Eu, Gd, Tb, Dy, Ho, Er, Ta, W, and combinations thereof (Instant paragraph [0035]).

Therefore, Summerfelt et al. teach these limitations because Summerfelt discloses metal-rich (free metal) dielectric layers.

Summerfelt fails to expressly disclose wherein said second dielectric layer has a lower oxygen concentration than said first dielectric layer or wherein said layers exhibit different amounts of oxygen per unit volume. However, Summerfelt is open to form a first layer of metal-doped strontium titanate (Table 2) (that is, a layer of strontium titanate with free metal therein) and a second layer of barium strontium titanate and metal-doped barium strontium titanate. Therefore, the ratio of oxygen and the amount of oxygen per unit volume in the second dielectric layer could be lower compared to the first dielectric layer of Summerfelt. Accordingly, Summerfelt inherently teaches upon the claimed invention.

### ***Conclusion***

1. Applicants are encouraged, where appropriate, to check Patent Application Information Retrieval (PAIR) (<http://portal.uspto.gov/external/portal/pair>) which provides applicants direct secure access to their own patent application status information, as well as to general patent information publicly available.



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2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Julio J. Maldonado whose telephone number is (571) 272-1864. The examiner can normally be reached on Monday through Friday.

3. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith, can be reached on (571) 272-1907. The fax number for this group is 571-273-8300. Updates can be found at

<http://www.uspto.gov/web/info/2800.htm>.

Julio J. Maldonado  
Patent Examiner  
Art Unit 2823

Julio J. Maldonado  
March 6, 2007



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